

requirement of stating whether other appeals or interferences which directly or have a bearing on the Board's decision on this appeal has been fulfilled.

The Examiner's Answer further states "[t]he appellant's statement of the status of amendments after final rejection contained in the brief is incorrect." The Examiner cites that the amendment after final rejection filed on December 9, 2002 has been entered. The Appellant concurs with the Examiner in that the amendment to the Specification made after the final rejection has been entered, but no amendments to the claims have been filed subsequent to their final rejection as stated in the Appeal Brief.

As will be explained in more detail below, the new points of argument presented by the Examiner with regard to the patentability of the pending claims of the case are respectfully traversed.

With regard to the patentability of Group I, Claims 1, 3-7, and 11, the Examiner disagrees with the Appellant's contention that Kim fails to teach or suggest a method for fabricating a metallization structure which includes applying a sufficient bias power to splash deposited metal at the bottom of a cavity to sidewalls of the cavity. In particular, the Examiner's Answer states on page 11, "... in light of the teachings of Kim, the Examiner maintains the position that the prior art will inherently generate the same splashing and depositing phenomenon recited in the instant claims upon selection of a wafer bias from 0 to 500 W (more particularly 500 W being a specific data point.)" The set of arguments used by the Examiner to support such a statement, however, are traversed as discussed in more detail below. The Examiner uses the same set of arguments to refute the Appellant's contention that teaching a range of bias power which is comparable to the exemplary levels cited in the Specification of the application does not necessarily teach the limitations of the presently claimed case.

The Appellant agrees with the Examiner's assertion that the claims are not limited to a particular wafer bias range or an amount of splashing. The Appellant disagrees, however, with the Examiner's contention that "... there is clear rationale for expecting that at least a portion of the titanium wetter layer [in Kim] will splash deposited metal at the bottom of the cavity onto the sidewalls." (Examiner's Answer, pages 9-10). The Examiner specifically cites the process conditions used by Kim as being similar to the presently claimed case, particularly with the wafer bias range 0-500 W taught in Kim encompassing the 100-200 W range taught in the Specification of the presently claimed case. Consequently, the Examiner contends that applying a sufficient wafer bias power to splash deposited metal at the bottom of a cavity to sidewalls of the cavity is an inherent characteristic of the method taught by Kim even though Kim is silent of such a teaching. It is asserted, however, that such an inherency contention is not adequately supported

since there is no extrinsic evidence teaching that a wafer bias may be set at a level sufficient to splash deposited metal from the bottom of a cavity onto sidewalls of the cavity.

“To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by person of ordinary skill.” *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991).

The Examiner’s Answer states that the conditions of Kim serve as extrinsic evidence that the missing descriptive matter is present within the prior art. Such a statement is traversed, however. In particular, the fact that Kim and the presently claimed case use similar process conditions to ion metal plasma deposit a layer does not provide extrinsic evidence of splashing deposited material from one region of a topography to another region of the topography.

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result of characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). MPEP 2112.

Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) MPEP 2112.

The Appellant agrees with the Examiner that Kim “... clearly teaches that at least a portion of the deposited titanium is formed upon the sidewalls,” as noted on page 10 of the Examiner’s Answer. Such a citing, however, fails to provide evidence that the titanium layer is deposited by splashing metal formed upon the base of the cavity onto the sidewalls of the cavity. Consequently, the citing does not provide extrinsic evidence of such a characteristic.

The Examiner’s Answer states that “... one of ordinary skill in the art would expect a bias of 500 W to be sufficient to splash deposited material at the bottom of the cavity to sidewalls of the cavity and therefore cause splashing.” (Examiner’s Answer, page 10). The Examiner’s Answer, however, fails to explain how one of ordinary skill in the art would acquire such an expectation without some teaching or suggestion that a wafer bias may be set at a level sufficient to splash previously deposited material onto other areas of a topography. No reference has been cited by the Examiner teaching such a phenomenon. Consequently, the Examiner’s contention that one skilled in the art would expect a bias of 500 W to be

sufficient to splash deposited material at the bottom of the cavity to sidewalls of the cavity is traversed. In the aforementioned case of *Continental Can Co. USA v. Monsanto Co.*,

The court went on to explain that this modest flexibility in the rule that ‘anticipation’ requires that every element of the claims appear in a single reference accommodates situations in which the common knowledge of the technologists is not recorded in the reference; that is, where technological facts are known to those in the field of the invention, albeit not known to judges.” 948 F.2d at 1268, 20 USPQ at 1749-50. MPEP 2131.02.

The Examiner, however, has failed to establish that setting a wafer bias at a level sufficient to splash previously deposited material onto other areas of a topography is common knowledge of those skilled in the art. As such, the claimed limitation of applying a sufficient bias power to splash deposited metal at the bottom of a cavity to sidewalls of the cavity cannot be an inherent characteristic of the method taught by Kim.

The Examiner further rejects the Appellants position that Kim fails to provide an adequate amount of specificity with which to anticipate the claimed bias power application. In particular, the Examiner argues that “... Kim teaches of a range of substrate biases (0-500 W, with 500 W being a specific data point) which is considered to be sufficiently specific with respect to the claim invention ...” (Examiner’s Answer, page 15). As noted above, Kim fails to teach or suggest splashing deposited material along the bottom of a cavity to sidewalls of the cavity. In fact, there is no teaching or suggestion in Kim of controlling the speed at which ionized target atoms are projected toward a surface through an application of wafer bias power such that a deposited material may be moved to another region of a topography. Rather, Kim only teaches that the trajectories of the ionized target atoms can be altered with an application of a bias power, as noted in the Appeal Brief. As such, splashing deposited metal from the bottom of a cavity to its sidewalls through the application of a sufficient bias power may be deemed an unexpected result in light of the teachings of Kim. Consequently, it is asserted that Kim does not provide an adequate amount of specificity with which to anticipate the limitations of claim 1.

In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with ‘sufficient specificity to constitute an anticipation under the statute.’ What constitutes a ‘sufficient specificity’ is fact dependent. If the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with ‘sufficient specificity’ to constitute an anticipation of the claims. The unexpected results may also render the claims unobvious. MPEP 2131.03

The Examiner further argues that "... it is equally applicable to argue that the claims lack sufficient specificity ... since the instant claims themselves fail [to] establish the degree of bias or degree of splashing." (Examiner's Answer, page 15). On the contrary, the limitation of claim 1 to apply a sufficient bias power with which to splash deposited material along the bottom of a cavity to sidewalls of the cavity provides an amount of specificity with which to conduct the claimed method. The burden is on the cited reference to teach an adequate amount of specificity to teach the limitations of the presently claimed case. Although claim 1 does not include a range of bias power with which to sufficiently cause metal deposited upon the bottom of a cavity to splash onto sidewalls of a cavity, the requirement of a reference to include a sufficient amount of specificity to teach the limitations of the claimed subject matter may be used to counter the Examiner's argument that the range taught in Kim inherently teaches the limitations of claim 1. The Examiner states that since bias power range cited in Kim encompasses the bias power ranged cited in the Specification of the presently claimed case, Kim inherently teaches applying a sufficient bias power to splash deposited material along the bottom of a cavity to sidewalls of the cavity. As noted above, however, the range cited in the Specification is narrower than the range taught in Kim and the narrow range appears to produce an unexpected result in light of the teachings of Kim. Consequently, the bias power range taught in Kim does not provide a sufficient amount of specificity with which to anticipate the claimed subject matter.

For at least the reasons set forth above, Kim does not anticipate the claimed limitations of claim 1. As such, Appellant's reassert that the Examiner has failed to support a ground of anticipation by Kim, and respectfully requests that the Board of Patent Appeals overturn the Examiner's rejections of present claims 1-11.

With regard to the patentability of Group II Claim 30, the Examiner disagrees with the Appellant's contention that Kim fails to teach or suggest ion metal depositing a wetting layer consisting essentially of titanium upon and in contact with the base and sidewalls of a cavity within a dielectric layer and subsequently sputter depositing a bulk metal layer upon and in contact with the wetting layer. The Examiner's Answer notes that the use of the term "consisting essentially of" in a claim does not exclude materials which do not materially affect the basic and novel characteristics of the claimed invention. While the Appellant agrees with such a contention, it is asserted that the method taught by Kim does not sputter deposit a bulk metal layer upon and in contact with a titanium wetting layer which is formed on and in contact with the base and sidewalls of a cavity without any materials which affect the basic and novel characteristics of the metallization structure. Consequently, Kim does not anticipate the limitations of claim 30.

As noted in the Appeal Brief, Kim discloses depositing a number of wetting layers within contact via 10 prior to the deposition of aluminum 28. However, not all of the wetting layers consist essentially of titanium. In particular, Kim teaches a barrier layer structure including "... second layer 20 of oxygen-stuffed titanium and/or titanium nitride." (Kim, column 8, lines 8-9) and "... third layer 24 of titanium nitride." (Kim, column 8, line 27). Kim does teach depositing first and fourth layers of titanium underneath and above the titanium nitride and oxygen-stuffed titanium layers. However, neither of the first and fourth titanium layers are arranged in upon and in contact with the base and the sidewalls of said cavity and with a subsequently deposited bulk metal layer as in the presently claimed case.

The Appeal Brief cites Kim specifically teaching the use of oxygen and/or nitride in combination with titanium to improve the characteristics of the metallization structure. In particular, Kim teaches depositing an oxygen-stuffed titanium layer "... in order to improve the effectiveness of the titanium and/or titanium nitride as a barrier layer. The presence of oxygen in the titanium matrix disrupts the formation of channels through which mobile silicon atoms can travel." (Kim, column 8, lines 13-17). In addition, Kim teaches depositing a titanium nitride layer within the contact via to serve "... as the main barrier layer to prevent migration of silicon to the top of the barrier structure, where it could react with aluminum during filling of the contact." (Kim, column 8, lines 31-33). As such, the burden of the Appellant to provide support that the inclusion of oxygen and/or nitrogen within the wetting layers of Kim has been met.

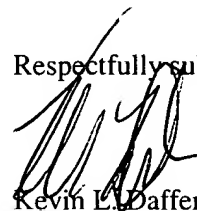
The Examiner's citing of column 2, lines 6-24 in Kim outlining the disadvantages of having the reactive specie of oxygen within a wetting layer does not negate the specific teachings to include nitrogen and/or oxygen within some of the wetting layers of the structure taught in Kim. In fact, the objective of Kim is to develop "... a method of depositing effective oxygen-containing barrier layer at bottom of a contact to prevent spiking, while minimizing the oxygen content on the contact via sidewalls to permit complete filling of very small contacts ..." (Kim, column 2, lines 25-29). As such, the aforementioned citation of Kim cannot be used to provide motivation to teach a method of forming a wetting layer consisting essentially of titanium (i.e., without the reactive species of oxygen and/or nitrogen) upon and in contact with the base and sidewalls of a cavity within a dielectric layer and subsequently forming a bulk metal layer upon such a wetting layer. In fact, such a citation rather affirms that the inclusion of oxygen within a wetting layer does materially affect the characteristics of the metallization structure and, therefore, a wetting layer consisting essentially of titanium may not include oxygen.

For at least the reasons set forth above, Kim does not anticipate the claimed limitations of claim 30. As such, Appellant's reassert that the Examiner has failed to support a ground of anticipation by Kim, and respectfully requests that the Board of Patent Appeals overturn the Examiner's rejections of claim 30.

### CONCLUSION

For all of the above reasons, and for reasons clearly stated in Appellant's Appeal Brief, it is believed that the claims are patentably distinct over the art of record. Appellants respectfully request that the Board of Patent Appeals overturn the Examiner's rejections.

Respectfully submitted,



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